IJBPAS, December, 2026, 15(12): 6126-6133

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

RELATIONSHIP BETWEEN DYNAMIC BALANCE AND AGILITY PERFORMANCE IN ADOLESCENT QUAD ROLLER SKATERS: A CORRELATION OBSERVATIONAL STUDY

MANSI S[1], SIDDHARTH J[2*] AND SHLESHA V[3]

1: MPT Scholar, Department of Physiotherapy, Ahmedabad Physiotherapy College, Parul University, Gujarat, India; **Orcid Id: 0009-0001-5321-6644**

2: Associate Professor, Department of Physiotherapy, Ahmedabad Physiotherapy College, Parul University, Gujarat, India; **Orcid Id: 0009-0003-0168-4352**

3: Principal, Master in Musculoskeletol & Sports, Ahmedabad Physiotherapy College, Parul University, Gujarat, India; **Orcid Id: 009-0008-2812-7341**

***Corresponding Author: Dr. Sidhharth Joshi: E Mail: dr.siddharthjoshi@yahoo.com**

Received 9th June 2026; Revised 15th July 2026; Accepted 4th Oct. 2026; Available online 1st Dec. 2026

https://doi.org/10.31032/IJBPAS/2026/15.12.10705

ABSTRACT

Background: Quad roller skating is a high-intensity sport requiring excellent dynamic balance, agility, coordination, and neuromuscular control to perform rapid directional changes while maintaining stability on a narrow base of support. Dynamic balance and agility are essential determinants of skating performance and may influence the risk of lower-extremity injuries among adolescent athletes. However, limited evidence exists regarding the relationship between these variables in adolescent quad roller skaters.

Purpose: To evaluate dynamic balance and agility among adolescent quad roller skaters and determine the relationship between these two performance variables.

Methodology: A correlation observational study was conducted among 35 adolescent quad roller skaters selected using convenience sampling. Dynamic balance was assessed using the Y-Balance Test, while agility was evaluated using the Agility T-Test under standardized testing conditions. Demographic characteristics including age, height, weight, body mass index (BMI), and skating experience were recorded. Data normality was assessed using the Shapiro–

Wilk test, and Pearson's correlation coefficient was used to determine the relationship between dynamic balance and agility.

Results: The mean Agility T-Test time was 11.60 ± 0.38 seconds, while the mean Y-Balance Test score was 82.10 ± 2.72%. Both variables were normally distributed (Shapiro–Wilk, $p > 0.05$). Pearson's correlation analysis demonstrated a very strong negative correlation between dynamic balance and agility ($r = –0.966$, $p < 0.001$), indicating that participants with better dynamic balance demonstrated superior agility performance.

Conclusion: The present study demonstrated a significant relationship between dynamic balance and agility among adolescent quad roller skaters. Better dynamic balance was associated with faster agility performance. These findings highlight the importance of assessing both components to optimize athletic performance and support injury prevention strategies in adolescent quad roller skaters.

Keywords: Quad roller skating, dynamic balance, agility, Y-Balance Test, Agility T-Test, adolescent athletes

INTRODUCTION

Quad roller skating is a high-intensity sport that requires excellent dynamic balance, agility, and neuromuscular control to perform rapid directional changes while maintaining stability on quad skates. These abilities are essential for optimal performance and injury prevention in adolescent skaters. The sport has gained increasing popularity among adolescents in both recreational and competitive settings **[1]**.

Adolescence is a key developmental window for motor skill acquisition and neuromuscular adaptations. However, rapid growth and immature movement patterns increase vulnerability to sports injuries. Adolescent athletes participating in multidirectional sports report high rates of musculoskeletal injuries, with ankle sprains being among the most common injuries **[2]**. Dynamic balance refers to the ability to maintain postural stability during movement or in response to external perturbations. In quad roller skating, continuous control of the centre of mass over a narrow base of support is essential. Deficits in dynamic balance are associated with impaired performance and an increased risk of lower-extremity injuries **[3, 4]**. The Star Excursion Balance Test (SEBT) and its modified version, the Y-Balance Test, are reliable and valid tools for assessing dynamic postural control and functional symmetry in athletes **[3, 5]**.

Agility is the ability to rapidly change direction while maintaining speed, balance, and body control. Quad roller skating requires frequent acceleration,

deceleration, pivoting, and multidirectional movements. Agility is closely associated with neuromuscular control, lower-limb power, and dynamic balance **[6]**. Studies have also demonstrated a significant relationship between dynamic balance and agility, suggesting that improvements in balance may enhance agility performance in athletes **[7]**. Furthermore, combined balance and plyometric training has been shown to improve athletic performance, including balance and agility, thereby reducing injury risk **[8]**.

Despite the increasing popularity of quad roller skating, scientific evidence regarding dynamic balance and agility among adolescent quad roller skaters remains limited. Most available literature focuses on inline skating or athletes from other sports, resulting in a lack of sport-specific normative data for quad roller skaters **[9]**.

This gap limits the development of evidence-based physiotherapy assessment protocols and injury prevention strategies tailored to this population.

Therefore, the present study aimed to evaluate dynamic balance and agility in adolescent quad roller skaters and to examine the relationship between these two variables. Establishing baseline data may assist physiotherapists, coaches, and sports professionals in designing evidence-based training and injury prevention programmes for adolescent quad roller skaters.

OBJECTIVES

- To assess dynamic balance among adolescent quad roller skaters using the Y-Balance Test.
- To assess agility performance among adolescent quad roller skaters using the Agility T-Test.
- To determine the relationship between dynamic balance and agility performance among adolescent quad roller skaters using Pearson's correlation coefficient.

METHODS

Study Design: A correlational observational study

Sample size: 35 adolescent quad roller skaters

Study population: Adolescent male quad roller skaters

INCLUSION CRITERIA

- Male quad roller skaters aged 11–16 years.
- Minimum 1 year of playing/ training experience in quad roller skating.
- No injury in the past 6 months.
- Able to complete all assessments without difficulty.

EXCLUSION CRITERIA

- Female players.
- Current or recent injury (within last 6 months).

- Neurological, cardiovascular, or respiratory disorders.
- Participation in other competitive sports at a high level.
- Use of performance-enhancing substances.
- Unable or unwilling to participate.

A total of **35 adolescent male quad roller skaters** aged 11–15 years were recruited using convenience sampling. Written informed consent was obtained from the participants and their parents/guardians before data collection. Demographic details, including age, height, weight, BMI, and skating experience, were recorded. Participants performed a standardized 10-minute warm-up before testing. Dynamic balance was assessed using the **Y-Balance Test**, followed by the **Agility T-Test** under standardized conditions. Three trials were completed for each test, and the best performance was recorded for analysis. The collected data were analysed using **Pearson's correlation coefficient** to determine the relationship between dynamic balance and agility performance.

OUTCOME MEASURES

Agility T-Test (ATT) - The Agility T-Test was performed on a flat, non-slippery surface marked with cones in a T-shape configuration (10 yards forward, 5 yards left/right, and 10 yards back). Participants started at the base of the T, sprinted forward to touch the middle cone, shuffled sideways to touch the left cone, shuffled to the right cone, shuffled back to the middle, and then backpedalled to the start. The test emphasizes quick changes in direction, acceleration, and deceleration. Participants were asked to complete the course as quickly as possible without crossing their feet during shuffles. The time was recorded using a stopwatch from start to finish.

Y Balance Test - The Y Balance Test was conducted on a stable surface with a Y-shaped apparatus marked with three reach directions (anterior, posteromedial, and posterolateral). Participants stood on one leg at the center, with hands on hips, and reached as far as possible with the opposite foot along each direction while maintaining balance. The reach distance was measured from the center to the point of toe touch, normalized to leg length for a composite score. The test assesses dynamic balance, postural control, and lower limb stability. Participants performed three trials per leg per direction, and the best reach was recorded.

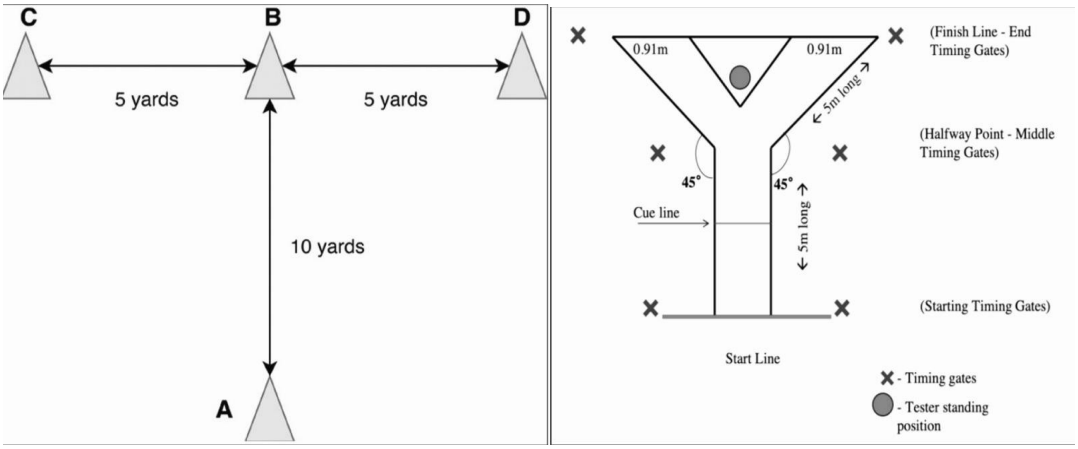


Figure 1: Agility -T Test & Y Balance Test

RESULTS

Table 1: Descriptive Statistics of Outcome Measures

Variable	Pre (Mean ± SD)	Post (Mean ± SD)	Mean Difference
Agility T-Test (seconds)	11.60 ± 0.38	10.75 ± 0.31	↓ 0.85 seconds
Y-Balance Test (% of leg length)	82.10 ± 2.72	86.40 ± 1.62	↑ 4.30 %

The mean Agility T-Test time improved from 11.60 ± 0.38 sec to 10.75 ± 0.31 sec. Y-Balance Test score increased from 82.10 ± 2.72% to 86.40 ± 1.62% after intervention.

Table 2: Normality Testing Using Shapiro–Wilk Test

Variable	W	p-value	Interpretation
Agility T-Test	0.961	0.247	Normally Distributed
Y-Balance Test	0.970	0.450	Normally Distributed

Both variables were normally distributed (p > 0.05). Therefore, Pearson's correlation analysis was performed.

Table 3: Correlation Between Dynamic Balance and Agility Performance (Pre-Test Values)

Variables	Pearson r	p-value	Interpretation
Y-Balance vs Agility T-Test	-0.966	<0.001	Very strong negative correlation

There was a very strong negative correlation (r = -0.966, p < 0.001). Better dynamic balance was strongly associated with faster agility performance

DISCUSSION

The present study found a very strong negative correlation between dynamic balance and agility among adolescent quad roller skaters ($r = –0.966$, $p < 0.001$), indicating that athletes with better dynamic balance demonstrated superior agility performance. This highlights the importance of postural control for efficient multidirectional movements in quad roller skating. These findings are consistent with Pueo *et al*., who reported that balance and agility tests are reliable indicators of athletic performance in young athletes **[10]**. Similarly, Muehlbauer *et al*. concluded that dynamic balance is closely associated with lower-limb strength, neuromuscular control, and motor performance, all of which contribute to improved agility and sports performance **[11]**.

The strong association observed in the present study may be explained by the shared neuromuscular mechanisms underlying both balance and agility. Effective proprioception, coordinated muscle activation, and postural stability

enable athletes to perform rapid acceleration, deceleration, and directional changes while maintaining body control. Lesinski *et al*. reported that balance training enhances neuromuscular function and improves motor performance in youth athletes, supporting the relationship observed in the present study **[12]**. Furthermore, Granacher *et al*. emphasized that balance is a fundamental component of athletic performance and should be incorporated into long-term athletic development programmes for children and adolescents **[13]**. Hrysomallis also highlighted that superior balance ability is associated with enhanced sports performance and may contribute to reducing lower-extremity injury risk **[14]**. These findings suggest that routine assessment of dynamic balance and agility may assist physiotherapists and coaches in identifying performance deficits and developing evidence-based training programmes for adolescent quad roller skaters.

CONCLUSION

The present study demonstrated a very strong negative correlation between dynamic balance and agility among adolescent quad roller skaters. Athletes with better dynamic balance exhibited superior agility performance, highlighting the close relationship between these two physical performance components. The findings suggest that dynamic balance plays a crucial role in efficient multidirectional movements required during quad roller skating. Assessment of dynamic balance and agility using the Y-Balance Test and Agility T-Test can help physiotherapists and coaches identify performance deficits and monitor athletes effectively. Further studies with larger and more diverse populations are recommended to confirm these findings and enhance their generalizability.

ACKNOWLEDGEMENT

I would like to take this opportunity to heartily acknowledge those who helped me throughout our project work. This would not been possible without them. I would like to express our deep sincere gratitude to our respected guide Dr. Siddarth Joshi for her keen interest shown in our project work.

REFERENCES

[1] Abhilash PV, Krishna HS, Anshumi BN. Comparison of core endurance and balance in roller-skating children with and without a history of ankle sprains. Khel J. 2025;12(4):899-905.

[2] Stockbridge MD, *et al*. Concussion in women's flat-track roller derby. Front Neurol. 2022;13:809939. doi:10.3389/fneur.2022.809939.

[3] Prieto-González P, Martínez-Castillo JL, Fernández-Galván LM, Casado A, Soporki S, Sánchez-Infante J. Epidemiology of sports-

related injuries and associated risk factors in adolescent athletes: an injury surveillance. Int J Environ Res Public Health. 2021;18(9):4857. doi:10.3390/ijerph18094857.

[4] Gribble PA, Hertel J, Plisky P. Using the Star Excursion Balance Test to assess dynamic postural-control deficits and outcomes in lower extremity injury: a literature and systematic review. J Athl Train. 2012;47(3):339-357. doi:10.4085/1062-6050-47.3.08.

[5] Mudaliar P, Dharmayat S. Influence of strength and proprioception training on functional ankle stability among young skaters. Indian J Physiother Occup Ther. 2020;14(3):37-42.

[6] Plisky PJ, Gorman PP, Butler RJ, Kiesel KB, Underwood FB, Elkins B. The reliability of an instrumented device for measuring components of the Star Excursion Balance Test. N Am J Sports Phys Ther. 2009;4(2):92-99.

[7] Chaouachi A, Brughelli M, Levin G, Ben Brahim NB, Cronin J, Chamari K. Anthropometric, physiological and performance characteristics of elite team-handball players. J Sports Sci. 2009;27(2):151-157. doi:10.1080/02640410802448731.

[8] Grabara M, Bieniec A. The relationship between functional movement patterns, dynamic balance and ice speed and agility. J Hum Kinet. 2024;80(1):207-214.

[9] Bouteraa I, Negra Y, Shephard RJ, Chelly MS. Effects of combined balance and plyometric training on athletic performance. J Strength Cond Res. 2020;34(7):1967-1973.

[10] Pueo B, Penichet-Tomás A, Jiménez-Olmedo JM. Reliability and usefulness of field-based physical fitness tests in sports: a systematic review. **Int J Environ Res Public Health.** 2020;17(21):7919. doi:10.3390/ijerph17217919. *(Open Access)*

[11] Muehlbauer T, Gollhofer A, Granacher U. Associations between balance measures and lower-extremity muscle strength and power in healthy individuals: a systematic review. **Sports Med.** 2015;45(12):1671-92.

[12] Lesinski M, Herz M, Schmelcher A, *et al*. Effects of balance training on balance performance in healthy children and adolescents: a systematic review and meta-

analysis. **Sports Med.** 2015;45(12):1721-38.

[13] Granacher U, Lesinski M, Büsch D, Muehlbauer T, Prieske O, Puta C, *et al*. Effects of resistance training in youth athletes on muscular fitness and athletic performance: a conceptual model for long-term athletic development. **Front Physiol.** 2016;7:164. doi:10.3389/fphys.2016.00164. *(Open Access)*

[14] Hrysomallis C. Relationship between balance ability, training and sports injury risk. **Sports Med.** 2007;37(6):547-56.